

SEQUENCE LISTING

&lt;110&gt; E. I. du Pont de Nemours and Company

&lt;120&gt; Genes Encoding Sulfate Assimilation Proteins

&lt;130&gt; BE-1167-B

&lt;140&gt;

&lt;141&gt;

&lt;150&gt; 60/092,833

&lt;151&gt; July 14, 1998

&lt;160&gt; 14

&lt;170&gt; Microsoft Office 97

&lt;210&gt; 1

&lt;211&gt; 890

&lt;212&gt; DNA

&lt;213&gt; Zea mays

&lt;400&gt; 1

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ccgtcgggaa atcgacgaac atcctgtggc atgagtgcgc catcggggcag aaggagcgac 120
agggctctgct gaaccagaag ggctgcgtcg tctggatcac tggcctaagc gggttcaggga 180
aaagcacgct cgcgtgcgcg ctgagccgcg agctgcacgg cagaggccac ctcacgtacg 240
tcctcgacgg cgacaacctc aggcacgggc tgaacaggga cctcagcttc ggagcagagg 300
accgcgccga gaacatccgc agagtggggg aagttagcga gctgttcgcc gacgctggcc 360
tcgtctgcat cgccagcctc atatcgccct acagaagcga ccgaagcgcg tgctcgcatc 420
tgctgccccaa gcaactcggtt atcgaggtgt tcctggacgt gccgcttcaa gtgtgcgaag 480
ccagggaccc caaaggcctc tacaagctcg cacgcgcggg caaaatcaaa ggggttcaccg 540
gcacgcagca tccttacgaa ccgccgtcgg actgtgagat agtgatccag tgtaaagtcg 600
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gtttcctcca ggactagaca tggaatgcga tcgatgcgtc tgatgtgtat atatgtagca 720
gcagccggag cggcattgcc aaggctgtgt aatctcatgg ctgtctttct ctttaagacc 780
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tgaatcaacc atgcttctga taaaaaaaaa aaaaaaaaaa aaaaaaaaaa 890

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&lt;210&gt; 2

&lt;211&gt; 224

&lt;212&gt; PRT

&lt;213&gt; Zea mays

&lt;400&gt; 2

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Ser Ala Ala Ala Val Ala Gly Ile Ser Ser Ser Ser Ala Leu
  1             5             10             15
Val Thr Ser Thr Val Gly Lys Ser Thr Asn Ile Leu Trp His Glu Cys
          20             25             30
Ala Ile Gly Gln Lys Glu Arg Gln Gly Leu Leu Asn Gln Lys Gly Cys
          35             40             45
Val Val Trp Ile Thr Gly Leu Ser Gly Ser Gly Lys Ser Thr Leu Ala
          50             55             60
Cys Ala Leu Ser Arg Glu Leu His Gly Arg Gly His Leu Thr Tyr Val
          65             70             75             80

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Ala Gly His Val Val Ser Tyr Leu Glu Thr Asn Gly Phe Leu Gln Asp  
210 215 220

<210>	3
<211>	1217
<212>	DNA
<213>	Zea mays

<400>	3						
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gacgccgacg	ctcgccgtca	tctctgtaaa	tccacagcgc	gcgcctcccg	tcttcccagg		180
cctcaccccc	agcgatgcgc	cactcccggc	gctcgtgatc	catggcctca	ctccccgttc		240
ctcacactct	tccgcgggtc	tcgccagtga	tagtgggcgc	cgcgaggggg	agggcgcgcg		300
ttcgcgtagc	gactgccacc	gcggcattgg	gcggtgggtg	cgcgcgcgcg	ggcggaattg		360
agcagcgccc	ggggaggccc	cgcacagccc	agtgaaggag	aagcctgtaa	tgtcgaacat		420
tgggaaatcg	actaatattt	tatggcacaa	ttgcttgatt	ggacaatctg	atagacagaa		480
attgctggga	caaaaaggct	gtgtcgtatg	gataacagga	ctcagtgggt	cagggaaaag		540
tactcttgca	tgtgcactga	gtcgtgagtt	gcattgcaga	ggccacctca	cgtatgtact		600
tgatggtgac	aacctcagac	atggcctaaa	tagagattta	agctttaagg	cagaagaccg		660
tgcagaaaaa	atacgaagag	ttgggtgaag	ggcaaaagct	tttgctgatg	ctggtgtcat		720
atgcatttgt	agcttgatat	ctccatacag	gagagatcgt	gatgcatgcc	gtgctctact		780
tccacattct	aactttattg	aagtatttat	tgatttgccc	ctaaaaattt	gtgaagctcg		840
tgatcctaaa	ggcctataca	agcttgcacg	tacaggaaa	attaaaggtt	tactggaat		900
tgatgatcca	tacgaaccac	caattaatgg	tgagatagta	attaagatga	aagatgagga		960
atgcccttca	cccaaagcaa	tggccaagca	agttctatgc	taccttgaag	aaaacggata		1020
tttgcaagct	tagtatatgt	attttgagaa	gattgatctg	attcttgtgt	gtccattact		1080
tgtggacaca	ataagatctg	ttgttggtca	catgaataaa	aggcatcaac	atgtaggaag		1140
taacagaagg	tacggttcat	tcagaaaacg	atatggattc	attcgtttaa	aaaaaaaaaa		1200
aaaaaaaaaa	aaaaaaaa						1217

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<210> 4
<211> 343
<212> PRT
<213> Zea mays
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<400> 4
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Gln Gln Pro Pro Ser Pro Ala Pro Gly Pro Ala Ser Gln Gly Gln Arg
          20           25           30

Gln Gly Asn Thr Leu Leu Ser Pro Thr Pro Thr Leu Ala Val Ile Leu
          35           40           45

Val Asn Pro Gln Arg Ala Pro Pro Val Leu Pro Gly Leu Thr Pro Ser
          50           55           60

Asp Ala Pro Leu Pro Ala Leu Val Ile His Gly Leu Thr Pro Arg Ser
          65           70           75           80

Ser His Ser Ser Ala Gly Leu Ala Ser Asp Ser Gly Arg Arg Glu Gly
          85           90           95

Glu Gly Arg Gly Ala Arg Thr His Cys His Arg Gly Ile Gly Arg Trp
          100          105          110

Val Arg Arg Arg Arg Arg Asn Gly Ala Ala Pro Gly Glu Ala Pro His
          115          120          125

Ser Pro Val Lys Glu Lys Pro Val Met Ser Asn Ile Gly Lys Ser Thr
          130          135          140

Asn Ile Leu Trp His Asn Cys Leu Ile Gly Gln Ser Asp Arg Gln Lys
          145          150          155          160

Leu Leu Gly Gln Lys Gly Cys Val Val Trp Ile Thr Gly Leu Ser Gly
          165          170          175

Ser Gly Lys Ser Thr Leu Ala Cys Ala Leu Ser Arg Glu Leu His Cys
          180          185          190

Arg Gly His Leu Thr Tyr Val Leu Asp Gly Asp Asn Leu Arg His Gly
          195          200          205

Leu Asn Arg Asp Leu Ser Phe Lys Ala Glu Asp Arg Ala Glu Asn Ile
          210          215          220

Arg Arg Val Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Val Ile
          225          230          235          240

Cys Ile Ala Ser Leu Ile Ser Pro Tyr Arg Arg Asp Arg Asp Ala Cys
          245          250          255

Arg Ala Leu Leu Pro His Ser Asn Phe Ile Glu Val Phe Ile Asp Leu
          260          265          270

Pro Leu Lys Ile Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu
          275          280          285

Ala Arg Thr Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr
          290          295          300

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Glu Pro Pro Ile Asn Gly Glu Ile Val Ile Lys Met Lys Asp Glu Glu  
305 310 315 320

Cys Pro Ser Pro Lys Ala Met Ala Lys Gln Val Leu Cys Tyr Leu Glu  
325 330 335

Glu Asn Gly Tyr Leu Gln Ala  
340

<210> 5  
<211> 431  
<212> DNA  
<213> Oryza sativa

<220>  
<221> unsure  
<222> (48)

<220>  
<221> unsure  
<222> (346)

<220>  
<221> unsure  
<222> (431)

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gtgccgaagg cgtccaatat cttctggcat gattgtgcag ttggccaggc tgatcggcag 120  
aagctactga agcagaaaagg ttgcgttggt ttgatcacag gacttagtgg ttcagggtaaa 180  
agtaccctgg catgcacatt agatcgagag ctccatacaa gagggaagct ttcttatggt 240  
cttgatggtg ataattttaag acatgggttg aacaaggatc ttggctttta ggcggaagac 300  
cgtgctgaaa atatacgcaa agttggtgag gtagcaaagc tattcncaga tgcaagccta 360  
gtatgcattg caagtttcaa atctccctat aagagagaac gtgagtcctg gccctgcaat 420  
attgtcaaat n 431

<210> 6  
<211> 118  
<212> PRT  
<213> Oryza sativa

<220>  
<221> UNSURE  
<222> (98)

<400> 6  
Ser Ile Val Pro Lys Ala Ser Asn Ile Phe Trp His Asp Cys Ala Val  
1 5 10 15

Gly Gln Ala Asp Arg Gln Lys Leu Leu Lys Gln Lys Gly Cys Val Val  
20 25 30

Trp Ile Thr Gly Leu Ser Gly Ser Gly Lys Ser Thr Leu Ala Cys Thr  
35 40 45

Leu Asp Arg Glu Leu His Thr Arg Gly Lys Leu Ser Tyr Val Leu Asp  
50 55 60

Gly Asp Asn Leu Arg His Gly Leu Asn Lys Asp Leu Gly Phe Lys Ala  
65 70 75 80

Glu Asp Arg Ala Glu Asn Ile Arg Lys Val Gly Glu Val Ala Lys Leu  
85 90 95

Phe Xaa Asp Ala Ser Leu Val Cys Ile Ala Ser Phe Lys Ser Pro Tyr  
100 105 110

Lys Arg Glu Arg Glu Ser  
115

<210> 7

<211> 936

<212> DNA

<213> Glycine max

<400> 7

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gcacgagcca ccggaagggc tctgacgacag ccctgctacg ccggaatcctt tcgcaacatc 60
gaatgcccgc cgtcgccggc ggcggagtcg ctagggtttc cgaagctccg cggaatcaac 120
gtcactggat tgcactgcgg ccgcccaggc ctgcctctcg tcctccgtgc aaaatcaaaag 180
ccgattaggg cgaaggagaa cgcaagcgta agtgcttctc tgatcgatga ctggttcaag 240
ccaattacgg cgaaggagga ttctaacgca gaggaccgta catcttcggt ttctggtaaa 300
aatctcacc cagatgtcaaa tgttggaac tcgacaaaca ttatgtggca tgactgtcca 360
attcagaaac aagatagaca gcagctgctt cagcaacaag gctgtgttat atggctaact 420
ggcctcagcg gatcaggaaa aagcactatt gcatgtgctc tgagtcaaag cttgcactcc 480
aaaggaaaac tgtcttacat ccttgatggt gacaatattc ggcatggtct aaaccaggat 540
cttagtttta gagcagaaga tcgttctgaa aacattagaa ggattggtga ggtggcaaaa 600
ctctttgcag atgctggtgt tatttgcac actagtttaa tatcaccata ccaaaaggat 660
agagatgcat gcagagcact actttcaaaa ggagatttta ttgaggtttt catagatgtt 720
ccactacatg tgtgtgaagc tagggaccca aagggaactc acaagcttgc tcgagctgga 780
aagatcaaag gtttctactg tatagatgat ccatatgaac caccgtgtag ttgtgagata 840
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<210> 8

<211> 311

<212> PRT

<213> Glycine max

<400> 8

Ala Arg Ala Thr Ala Lys Ala Leu Arg Gln Pro Cys Tyr Ala Gly Ile  
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Phe Arg Asn Ile Glu Cys Gly Pro Ser Pro Ala Ala Glu Ser Leu Gly  
20 25 30

Phe Pro Lys Leu Arg Gly Ile Asn Val Thr Gly Leu His Cys Gly Arg  
35 40 45

Arg Gly Leu Val Leu Val Leu Arg Ala Lys Ser Lys Pro Ile Arg Ala  
50 55 60

Lys Glu Asn Ala Ser Val Ser Ala Ser Leu Ile Asp Asp Trp Phe Lys  
65 70 75 80

Pro Ile Thr Ala Lys Glu Asp Ser Asn Ala Glu Asp Arg Thr Ser Ser  
85 90 95

Phe Ser Gly Lys Asn Leu Thr Gln Met Ser Asn Val Gly Asn Ser Thr  
100 105 110

Asn Ile Met Trp His Asp Cys Pro Ile Gln Lys Gln Asp Arg Gln Gln  
 115 120 125  
 Leu Leu Gln Gln Gln Gly Cys Val Ile Trp Leu Thr Gly Leu Ser Gly  
 130 135 140  
 Ser Gly Lys Ser Thr Ile Ala Cys Ala Leu Ser Gln Ser Leu His Ser  
 145 150 155 160  
 Lys Gly Lys Leu Ser Tyr Ile Leu Asp Gly Asp Asn Ile Arg His Gly  
 165 170 175  
 Leu Asn Gln Asp Leu Ser Phe Arg Ala Glu Asp Arg Ser Glu Asn Ile  
 180 185 190  
 Arg Arg Ile Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Val Ile  
 195 200 205  
 Cys Ile Thr Ser Leu Ile Ser Pro Tyr Gln Lys Asp Arg Asp Ala Cys  
 210 215 220  
 Arg Ala Leu Leu Ser Lys Gly Asp Phe Ile Glu Val Phe Ile Asp Val  
 225 230 235 240  
 Pro Leu His Val Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu  
 245 250 255  
 Ala Arg Ala Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr  
 260 265 270  
 Glu Pro Pro Cys Ser Cys Glu Ile Val Leu Gln Gln Lys Gly Ser Asp  
 275 280 285  
 Cys Lys Ser Pro Ser Asp Met Ala Glu Glu Val Ile Ser Tyr Leu Glu  
 290 295 300  
 Glu Asn Gly Tyr Leu Arg Ala  
 305 310

<210> 9  
 <211> 928  
 <212> DNA  
 <213> Triticum aestivum

<400> 9  
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 tggctgccgg gaagcagccc gtcaatggat cagccatggc aggtatcgac aagcttgtga 120  
 cctcaactgt tgggaaatcg acaaacgttc tttggcatga ctgtccaata ggtcagtttg 180  
 agaggcagga actgctaaat cagaagggtt gtgttggtg gataacaggg ttaagtgggt 240  
 cagggaaaag cacactagca tgcgcgctaa gtcgcgagct gcactccaga ggtcatctga 300  
 cctacattct agacggtgac aatctaaggc atgggttaaa ccgagacctc tgtttcgaag 360  
 caaaggaccg tgctgaaaat atacgcagag taggagaagt agcaaagctg tttgcagatg 420  
 ctggtctgat ctgcattgct agcttgatat caccctacag aagtgaacgc agcgcttgcc 480  
 gcaaattact gcacaattct acattcatcg aggtgtttt gaatgtccca cttgaagttt 540  
 gtgaagctag ggatccaaaa ggcttgatca agcttgccc tgcaggaaaa atcaaagggt 600  
 ttactggaat tgatgatcct tatgaagcac cttctgactg cgagatagtg atacagtgc 660  
 aagctggtga ctgcgccacg cctaaatcga tggctgatca agttgtgtca tatctgaag 720  
 caaatgagtt cttacaggaa tagagacgta tgctatggat gaaaaaacat tctgaaattg 780  
 gatcgccaag ggatgtgaaa tatgaggtag tatttatgtc tagaaagagt gatgatagta 840  
 tgagaacata tatattgaca taaagatcga atctgtacat cattataata aattgaaatg 900

ttttgacgca aaaaaaaaaa aaaaaaaaaa

928

&lt;210&gt; 10

&lt;211&gt; 246

&lt;212&gt; PRT

&lt;213&gt; Triticum aestivum

&lt;400&gt; 10

Thr Arg Ala Asp Ala Gly Glu Arg Met Ala Gly Ser Glu Ala Val Pro  
 1 5 10 15

Val Val Ala Val Ala Ala Gly Lys Gln Pro Val Asn Gly Ser Ala Met  
 20 25 30

Ala Gly Ile Asp Lys Leu Val Thr Ser Thr Val Gly Lys Ser Thr Asn  
 35 40 45

Val Leu Trp His Asp Cys Pro Ile Gly Gln Phe Glu Arg Gln Glu Leu  
 50 55 60

Leu Asn Gln Lys Gly Cys Val Val Trp Ile Thr Gly Leu Ser Gly Ser  
 65 70 75 80

Gly Lys Ser Thr Leu Ala Cys Ala Leu Ser Arg Glu Leu His Ser Arg  
 85 90 95

Gly His Leu Thr Tyr Ile Leu Asp Gly Asp Asn Leu Arg His Gly Leu  
 100 105 110

Asn Arg Asp Leu Cys Phe Glu Ala Lys Asp Arg Ala Glu Asn Ile Arg  
 115 120 125

Arg Val Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Leu Ile Cys  
 130 135 140

Ile Ala Ser Leu Ile Ser Pro Tyr Arg Ser Glu Arg Ser Ala Cys Arg  
 145 150 155 160

Lys Leu Leu His Asn Ser Thr Phe Ile Glu Val Phe Leu Asn Val Pro  
 165 170 175

Leu Glu Val Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu Ala  
 180 185 190

Arg Ala Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr Glu  
 195 200 205

Ala Pro Ser Asp Cys Glu Ile Val Ile Gln Cys Lys Ala Gly Asp Cys  
 210 215 220

Ala Thr Pro Lys Ser Met Ala Asp Gln Val Val Ser Tyr Leu Glu Ala  
 225 230 235 240

Asn Glu Phe Leu Gln Glu  
 245

&lt;210&gt; 11

&lt;211&gt; 521

&lt;212&gt; DNA

&lt;213&gt; Triticum aestivum

<400> 11  
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aggcaatggc ccagcaagtt ctgtcctacc ttgagaagaa cggatatttg caggcttagc 180  
atatatatac tccagatcca gaagattgaa cttattcttc tgtgtccata actcatggac 240  
acaggcatga tccatttggc cgcacccgga ataaaaggcg ctgttattga agcaacaagc 300  
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cctctcgcgc gtgttgtgct attttagctg tagtctatac ttgctcattt cggctgaaat 420  
ggtgtgctgt gctgtgctgt gtttatttgt tggtaatgta tgatttgatt gtgggtgtca 480  
aaagtacgaa tgaataaatc gtgcttgctt tttcaaaaaa a 521

<210> 12  
<211> 58  
<212> PRT  
<213> Triticum aestivum

<400> 12  
Thr Arg Leu Ala Arg Thr Gly Lys Ile Lys Gly Phe Thr Gly Val Asp  
1 5 10 15  
Asp Pro Tyr Glu Ser Pro Val Asn Ser Glu Ile Val Ile Lys Met Glu  
20 25 30  
Gly Gly Glu Cys Pro Ser Pro Lys Ala Met Ala Gln Val Leu Ser  
35 40 45  
Tyr Leu Glu Lys Asn Gly Tyr Leu Gln Ala  
50 55

<210> 13  
<211> 312  
<212> PRT  
<213> Catharanthus roseus

<400> 13  
Met Ile Gly Ser Val Lys Arg Pro Val Val Ser Cys Val Leu Pro Glu  
1 5 10 15  
Phe Asp Phe Thr Glu Ser Thr Gly Leu Gly Lys Lys Ser Ser Ser Val  
20 25 30  
Lys Leu Pro Val Asn Phe Gly Ala Phe Gly Ser Gly Gly Gly Glu Val  
35 40 45  
Lys Leu Gly Phe Leu Ala Pro Ile Lys Ala Thr Glu Gly Ser Lys Thr  
50 55 60  
Ser Ser Phe Gln Val Asn Gly Lys Val Asp Asn Phe Arg His Leu Gln  
65 70 75 80  
Pro Ser Asp Cys Asn Ser Asn Ser Asp Ser Ser Leu Asn Asn Cys Asn  
85 90 95  
Gly Phe Pro Gly Lys Lys Ile Leu Gln Thr Thr Thr Val Gly Asn Ser  
100 105 110  
Thr Asn Ile Leu Trp His Lys Cys Ala Val Glu Lys Ser Glu Arg Gln  
115 120 125



Glu Pro Leu Gln Gln Arg Gly Cys Val Ile Trp Ile Thr Gly Leu Ser  
 130 135 140  
 Gly Ser Gly Lys Ser Thr Leu Ala Cys Ala Leu Ser Arg Gly Leu His  
 145 150 155 160  
 Ala Lys Gly Lys Leu Thr Tyr Ile Leu Asp Gly Asp Asn Val Arg His  
 165 170 175  
 Gly Leu Asn Ser Asp Leu Ser Phe Lys Ala Glu Asp Arg Ala Glu Asn  
 180 185 190  
 Ile Arg Arg Ile Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Val  
 195 200 205  
 Ile Cys Ile Ala Ser Leu Ile Ser Pro Tyr Arg Lys Pro Pro Asp Ala  
 210 215 220  
 Cys Arg Ser Leu Leu Pro Glu Gly Asp Phe Ile Glu Val Phe Met Asp  
 225 230 235 240  
 Val Pro Leu Lys Val Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys  
 245 250 255  
 Leu Ala Arg Ala Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro  
 260 265 270  
 Tyr Glu Pro Pro Leu Lys Ser Glu Ile Val Leu His Gln Lys Leu Gly  
 275 280 285  
 Met Cys Asp Ser Pro Cys Asp Leu Ala Asp Ile Val Ile Ser Tyr Leu  
 290 295 300  
 Glu Glu Asn Gly Tyr Leu Lys Ala  
 305 310  
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 <211> 276  
 <212> PRT  
 <213> Arabidopsis thaliana  
 <400> 14  
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 Val Val Val Arg Ala Cys Val Ser Met Asp Gly Ser Gln Thr Leu Ser  
 35 40 45  
 His Asn Lys Asn Gly Ser Ile Pro Glu Val Lys Ser Ile Asn Gly His  
 50 55 60  
 Thr Gly Gln Lys Gln Gly Pro Leu Ser Thr Val Gly Asn Ser Thr Asn  
 65 70 75 80  
 Ile Lys Trp His Glu Cys Ser Val Glu Lys Val Asp Arg Gln Arg Leu  
 85 90 95

Leu Asp Gln Lys Gly Cys Val Ile Trp Val Thr Gly Leu Ser Gly Ser  
 100 105 110  
 Gly Lys Ser Thr Leu Ala Cys Ala Leu Asn Gln Met Leu Tyr Gln Lys  
 115 120 125  
 Gly Lys Leu Cys Tyr Ile Leu Asp Gly Asp Asn Val Arg His Gly Leu  
 130 135 140  
 Asn Arg Asp Leu Ser Phe Lys Ala Glu Asp Arg Ala Glu Asn Ile Arg  
 145 150 155 160  
 Arg Val Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Ile Ile Cys  
 165 170 175  
 Ile Ala Ser Leu Ile Ser Pro Tyr Arg Thr Asp Arg Asp Ala Cys Arg  
 180 185 190  
 Ser Leu Leu Pro Glu Gly Asp Phe Val Glu Val Phe Met Asp Val Pro  
 195 200 205  
 Leu Ser Val Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu Ala  
 210 215 220  
 Arg Ala Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr Glu  
 225 230 235 240  
 Pro Pro Leu Asn Cys Glu Ile Ser Leu Gly Arg Glu Gly Gly Thr Ser  
 245 250 255  
 Pro Ile Glu Met Ala Glu Lys Val Val Gly Tyr Leu Asp Asn Lys Gly  
 260 265 270  
 Tyr Leu Gln Ala  
 275